

*THE INFLUENCE OF COLD IN STIMULATING THE GROWTH
OF PLANTS*

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In regions having a cold winter like ours, with prolonged or repeated freezing, the native trees and shrubs, according to the general belief, become dormant because of the cold. It is also the general belief that warm weather is of itself the sufficient cause of the beginning of new growth in spring. Both these ideas are erroneous. The evidence now presented shows: first, that in our native trees and shrubs, dormancy sets in before cold weather, and that cold weather is not necessary for the establishment of complete dormancy; second, that after such dormancy has begun, the exposure of the plants to an ordinary growing temperature does not start them into growth; third, that these plants will not resume normal growth in the warm weather of spring unless they have been subjected previously to a period of chilling.

Dormant trees and shrubs which have had two or three months of chilling, either out of doors or in artificial cold storage, start into growth in the normal manner when spring comes, but if the dormant plants have been kept warm all winter they do not start into growth at the usual time in spring but continue their dormant condition for weeks or months, sometimes for a whole year, and when finally they do begin to grow their growth is of an abnormal character. One of these long dormant plants can readily be started into healthy growth, however, even after the expiration of a year, by subjecting it to a period of chilling. The best temperature for chilling is 32° to 40° Fahrenheit. It may be applied in either light or darkness.

In one of the greenhouses of the Department of Agriculture refrigerating machines have been installed in such a manner that plants supplied with normal daylight can be subjected at any period of the year to winter temperatures, even below freezing if desired.

By subjecting one part of a dormant bush to a chilling temperature and keeping the other part of it warm, the chilled portion can be brought into full leaf and flower while the other part remains completely dormant.

An important change takes place in the plant during the process of chilling. The starch stored in the cells is transformed to sugar, and not until this has been done can the plant utilize its store of starch in making its spring growth. Furthermore, the transformation of the starch into sugar creates high osmotic pressures within the plant. Certain sugar-exuding glands, called extra-floral nectaries, are interpreted as safety valves for the relief of excessive internal pressures which might burst the cells of the plant or otherwise derange its physiological activities.

The fact that our northern trees and shrubs after they become dormant in the fall require a period of chilling before warm weather will start them into growth again, is a protective adaptation of the highest importance to these plants, for if warmth alone would start them into growth they would begin growing in Indian summer and the stored food that the plant requires for its normal vigorous growth in the following spring would be wasted in a burst of new autumn growth, which would be killed by the first heavy freezes, and would be followed by a winter of weakness and probable death.

Further investigations on the effects of chilling are urged upon those engaged in experimentation bearing on the improvement of horticultural and agricultural practices. It is desirable especially to determine the proper temperatures for the storage of different kinds of seeds, bulbs, cuttings, and grafting wood; proper temperatures for the treatment of plants which are to be forced from dormancy to growth at unusual seasons; and proper temperatures for the storage of nursery stock, so that the nurseryman may have plants in proper condition for shipment on any date he desires.

ON THE NATURE OF THE NEGATIVE CARRIERS PRODUCED
IN PURE HYDROGEN AND NITROGEN BY PHOTO-
ELECTRONS

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As the result of an investigation of the cause of the abnormalities of the negative ions in air at low pressures (which is to appear shortly), it was found that the results obtained could be explained quite satisfactorily on the basis of a theory proposed by Sir J. J. Thomson.¹ This theory assumes that the electron does not attach to a neutral molecule to generate a negative ion on its first impact, but that on the average it will have a chance of uniting in one out of n impacts with a given type of molecule, where n is a constant which is a characteristic of the type of molecule considered. For air this constant was found to be in the neighborhood of 2.5×10^6 . If the oxygen molecule is the molecule to which the negative electron attaches in air—a point of view for which there is considerable evidence—this means that in only one out of 5×10^4 encounters with oxygen molecules does the electron have a chance of attaching itself to a molecule to form a negative ion. It accordingly seemed of interest to see how nitrogen and hydrogen molecules behaved in respect to this theory, and to determine n for them if possible.